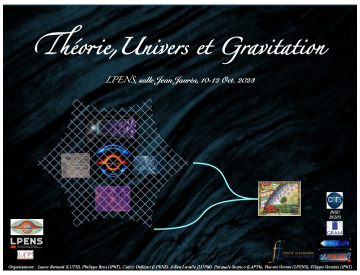

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Sami Viollet (CPT Marseille): Discreteness Unravels the Black Hole Information Puzzle: Insights from a Quantum Gravity Toy Model

mardi 10 octobre 2023 12:10 (20 minutes)

The black hole information puzzle can be resolved if two conditions are met. Firstly, if the information of what falls inside a black hole remains encoded in degrees of freedom that persist after the black hole completely evaporates. Secondly, if these degrees of freedom do not significantly contribute to the system's energy, as the macroscopic mass of the initial black hole has been radiated away as Hawking radiation to infinity. The presence of Planckian geometric degrees of freedom provides a natural mechanism for achieving these two conditions. During this talk, I will illustrate both key aspects of this mechanism using a solvable toy model of a quantum black hole inspired by loop quantum gravity. I will first argue about how some aspects of the quantum gravity dynamics of black holes emitting Hawking radiation can be modelled using Kantowski-Sachs solutions, with a massless scalar field describing the ingoing Hawking particle, when one focuses on the deep interior region r « 2M (including the singularity). Further, I will show that in the r « 2M regime, and in suitable variables, this model becomes exactly solvable at both the classical and quantum levels. The quantum dynamics inspired by loop quantum gravity is revisited. I will propose a natural polymer-quantization where the area of the orbits of the rotation group is quantized. The Dirac observable associated to the mass is quantized and shown to have an infinite degeneracy associated to the so-called ε-sectors, interpretable as Planckian geometric degrees of freedom. Suitable continuum superpositions of these are well defined distributions in the physical Hilbert space and satisfy the quantum dynamics. Finally, I'll explain how correlations between the outgoing Hawking particle and the ingoing one dissipate in favor of correlations with the Planckian geometric degrees of freedom. The latter therefore seem necessary to restore the purity of the outgoing Hawking radiation.

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